Lucas, S.G. and Spielmann, J.A., eds., 2007, The Global Triassic. New Mexico Museum of Natural History and Science Bulletin 41.

TOPOTYPES OF *TYPOTHORAX COCCINARUM*, A LATE TRIASSIC AETOSAUR FROM THE AMERICAN SOUTHWEST

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Abstract—The syntype specimens of the aetosaur *Episcoposaurus horridus* Cope, 1887, are from the type locality of *Typothorax coccinarum* Cope, 1875, in the Painted Desert Member of the Petrified Forest Formation, Chinle Group at Cerro Blanco, Rio Arriba County, New Mexico. The syntypes of *E. horridus* are topotypes of *T. coccinarum,* and some probably represent the same individual as the lectotype of *T. coccinarum*. *E. horridus* is a junior subjective synonym of *T. coccinarum,* and we restrict the lectotype of *E. horridus* to a single caudal dorsal paramedian osteoderm. The topotypes of *T. coccinarum* provide a more complete picture of the anatomy of the species and further confirm its distinctiveness from *T. antiquum*.

INTRODUCTION

Aetosaurs are heavily armored archosaurs known from Upper Triassic strata in North and South America, Greenland, Europe, India, North Africa and Madagascar (Heckert and Lucas, 2000). The first aetosaur named from the American Southwest was *Typothorax coccinarum* Cope, 1875, based on specimens Cope collected in 1874 near Gallina in Rio Arriba County, New Mexico (Fig. 1). In 1881, Cope's hired fossil collector, David Baldwin, collected additional aetosaur specimens from the same locality near Gallina, and they became the type material of *Episcoposaurus horridus* Cope, 1887, long regarded as a synonym of *T. coccinarum*. This material thus is topotypic of *Typothorax coccinarum* and further establishes the distinctive morphology of this biostratigraphically significant species.

Institutional abbreviations: AMNH = American Museum of Natural History, New York; NMMNH = New Mexico Museum of Natural History, Albuquerque.

HISTORY

Camp (1930) and Lucas and Hunt (1992) relocated the type locality of *Typothorax coccinarum*, which is just north of Cerro Blanco near Gallina, New Mexico in the Painted Desert Member of the Petrified Forest Formation (also see Lucas et al., 2005a, b). In 1881, Cope's hired collector David Baldwin collected from the same locality additional aetosaur (and phytosaur) fossils that became the type material (syntypes) of *Episcoposaurus horridus* Cope, 1887. Baldwin's packing label (also see Heckert and Lucas, 2002, p. 203) with the type material reads:

> Sack 3, Box 2.
> 1881 Prof. E.D. Cope,
> 2100 Pine St. Philadelphia.
>
> Contains: Part of fossils— bones dug out Gallina Pan on April 12th to May 1 Triassic or Jurassic 200 ft below Gypsum, 150 ft above Gray sand stone – No head-no foot 3 teeth(?) only.
>
> D. Baldwin
>
> Lower jaw! [note added later, connected to "no head"— this lower jaw is probably the phytosaurian jaw Cope (1887) excluded from the type material (Gregory, 1953, p. 3)]

It is reasonable to infer that Baldwin was collecting at the *Typothorax coccinarum* locality discovered by Cope in 1874. Indeed, Cope (1887, p. 213) stated that "this species [*Episcoposaurus horridus*] is indicated by a number of bones which were excavated at the same place [as the type material of *T. coccinarum*]." Furthermore, Huene (1915, p. 492) noted that "in the Triassic Cope collection many bones and fragments are marked with the same number (2307) as the type specimens; that means they come from the same place." This even raises the possibility that at least some of the type material of *T. coccinarum* and *E. horridus* represents a single individual (see below). Note also that the AMNH online catalog erroneously lists the locality of the type material of *E. horridus* as "Arroyo Seco?," which is many km from Cerro Blanco (Fig. 1).

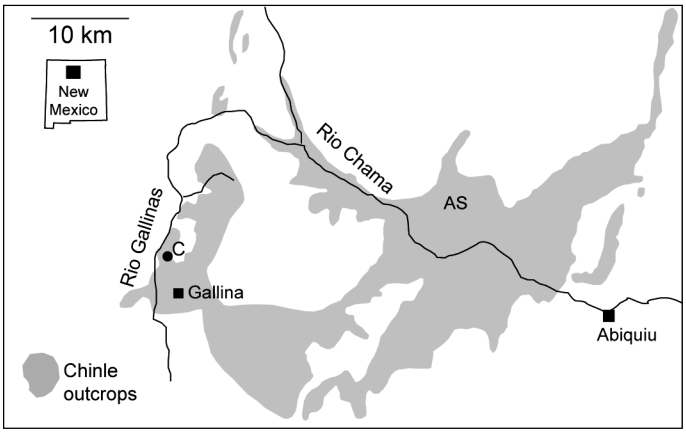

FIGURE 1. Distribution of Chinle Group outcrops in the Chama basin of northern New Mexico showing location of type locality of *Typothorax coccinarum* and *Epsicoposaurus horridus* at Cerro Blanco near Gallina (C) and the location of the Arroyo Seco (AS) area to the east.

In naming *Episcoposaurus horridus*, Cope (1887, p. 213) listed the type material as "two caudal vertebrae, a proximal and a distal; a humerus; two ulnae; a femur lacking the condyles; a proximal part of a fibula; a calcaneum; and a number of dermal bones. The only part of the skull possibly belonging to this animal is a splenial bone." Cope (1887) provided no illustrations of these specimens, but Huene (1915, figs. 12-15, 18-27) did. Huene (1915, p. 492-499) also redescribed the type material of *E. horridus* and (p. 493) excluded the humerus, radius and ulna from it because they "are so very much smaller than those of the hind leg that…it seems impossible that the animal could have been so disproportionate." He thus restricted the type to "the bones of the hind leg as the real type of this species, appending also the splenials, the two caudals and possibly some of the scutes" (Huene, 1915, p. 493).

Gregory (1953a, p. 1-2) noted that "Cope's original type of *Episcoposaurus horridus* is hopelessly mixed with bones of other individuals, some of which were referred by him, and later by von Huene

(1915A), to *Typothorax*, and which include characteristic dorsal armor of that genus." Gregory (1953) went on to conclude that *E. horridus* is a synonym of *T. coccinarum*. He reviewed the history of *E. horridus*, noting that its type material came from the same locality as the type material of *T. coccinarum* and stated that:

> …the probable association of *Episcoposaurus* femur (lectotype of *E. horridus*) with unmistakable armor of *Typothorax*, and the further likelihood that the supposed distinctive armor of *Episcoposaurus* is merely that of the tail rather than thorax or abdomen, and finally the intimate association of the type specimen of *Episcoposaurus horridus* with bones referred by Cope as well as subsequent students to *Typothorax coccinarum*, all suggest that only one species is present. If this be so (it is probably incapable of absolute proof), *Episcoposaurus* is a synonym of *Typothorax* having been established upon remains of the same species (Gregory, 1953, p. 6).

Gregory (1953a, p. 10) went on to list the type of *Episcoposaurus* as:

> Type of *Episcoposaurus horridus*: A.M.N.H., no 2713 (formerly 2307). Two caudal vertebrae (proximal and distal); humerus; two ulnae; femur lacking condyles; proximal part of tibia; distal part of fibula; calcaneum; a number of dermal bones. Splenial possibly associated. Von Huene (1915, p. 492-493) designated bones of hind leg as lectotype. From same locality as type of *Typothorax coccinarum*. Collected by David Baldwin, April 12, 1881.

Long and Ballew (1985, p. 61-62) supported Gregory's conclusion that the osteoderms that are part of the syntypes of *E. horridus* belong to *T. coccinarum*. Long and Murry (1995, p. 101) thus listed *Episcoposaurus horridus* as a junior subjective synonym of *Typothorax coccinarum* Cope, 1875. They also listed AMNH 2713 as coming from the same locality (Cerro Blanco) as the holotype of *T. coccinarum*. AMNH 2712, a calcaneum, is also from this site, as is AMNH 2710. The splenial included with the type material of *E. horridus* (Huene, 1915, fig. 20) is that of a phytosaur.

Heckert and Lucas (2000) followed previous workers and considered *Episcoposaurus horridus* a junior subjective synonym of *Typothorax coccinarum* in their review of the Stagonolepididae. Heckert and Lucas (2002) also noted that, in spite of the extensive work by Huene (1915), Gregory (1953a, b), Long and Ballew (1985) and Long and Murry (1995), no one had ever designated a lectotype for *Episcoposaurus haplocerus*, widely regarded as the type of *Desmatosuchus haplocerus*. Consequently, they (Heckert and Lucas, 2002, p. 194) designated an osteoderm from the type locality of *Episcoposaurus haplocerus*, in the Tecovas Formation of West Texas as the lectotype. They also described and illustrated (Heckert and Lucas, 2002, figs. 4-5) topotypic material from the type locality of *Typothorax coccinarum*.

LECTOTYPE AND SYNTYPES OF *EPISCOPOSAURUS HORRIDUS*

The aetosaur specimens that are included in the type material of *Episcoposaurus horridus* listed by Cope (1887), Huene (1915) and Gregory (1953a) comprise an assemblage of bones that represent more than a single individual (see below). We therefore regard these listings as designations of syntypes. We advocate restricting the type of *E. horridus* to a single lectotype bone. In this case, we designate the complete left dorsal caudal paramedian osteoderm of AMNH 2713 (Fig. 3A; Gregory, 1953a, fig. 17) the lectotype. This eliminates the confusion over association of the syntypes well discussed by Huene (1915) and Gregory (1953a).

The lectotype corresponds well anatomically to dorsal caudal paramedian osteoderms of *Typothorax coccinarum* (Hunt et al., 1993). As noted above, *Episcoposaurus horridus* has long been considered a junior subjective synonym of *Typothorax coccinarum* (Gregory, 1953; Long and Ballew, 1985; Long and Murry, 1995), and restriction of the lectotype to a single osteoderm does not change, but does formalize, this synonymy.

The various other syntypes of *Episcoposaurus horridus* consist of a caudal centrum (Fig. 2A-C), two left? dorsal paramedian osteoderms (Fig. 2D-G), one right? paramedian osteoderm (Fig. 2H), one left lateral osteoderm (Fig. 2I), two right? lateral osteoderms (Figs. 2J, 3C-D), three left caudal paramedian osteoderms (Fig. 3B, E-G), one right caudal paramedian osteoderm (Fig. 3H), a complete right humerus (Fig. 4A-B), a complete left ulna (Fig. 4C), a proximal right ulna (Fig. 4D-E), a proximal left? radius (Fig. 4F-G), a complete right femur (Fig. 5A), a left proximal tibia (Fig. 5B), two right? proximal tibiae (Fig. 5F-J), a distal tibia (Fig. 5C-E) and a left calcaneum (Fig. K-M).

The dorsal paramedian osteoderms clearly demonstrate the characteristic ornamentation of *Typothorax coccinarum*: random pitting, prominent anterior bar, lack of ornamentation and a ventral keel (compare Figs. 2D-H, 3 to Long and Ballew, 1985, figs. 8-11, pls. 2-3 and Long and Murry, 1995, fig. 100). Likewise, the lateral osteoderms (Figs. 2I-J, 3C-D) show the characteristic dorsoventral compression and laterally-directed sharp edge for which this taxon is known. The caudal paramedian osteoderms (Fig. 3B, E-G) possess an anterior bar and ornamentation identical to the same elements in NMMNH P-12964, a nearly complete articulated specimen of *T. coccinarum* (Hunt et al., 1993). The right humerus (Fig. 4A) has expanded proximal and distal ends, with the distal end having prominent condyles; morphologically this specimen appears identical to a *T. coccinarum* humerus illustrated by Long and Murry (1995, fig. 105). The ulnae (Fig. 4C-E) are anteroposteriorly compressed and lack a prominent olecranon process while the proximal left? radius is elliptical in proximal view; these elements are identical to the ulnae and radii of NMMNH P-12964. The femur (Fig. 5A) bears a small fourth trochanter and prominent distal condyles and appears identical to *T. coccinarum* femora illustrated by Long and Murry (1995, fig. 110). The proximal tibia fragments (Fig. 5B, F-J) are elliptical in proximal view with prominent proximal articulation and a more slender shaft. The distal tibia fragment (Fig. 5C-E) has offset facets on its distal articulation and is kidney-shaped in distal view. The left calcaneum (Fig. 5K-M) is complete with a prominent dorsal process, and a ridge on the ventrolateral margin of the calcaneal shaft. This specimen was previously described and illustrated as *T. coccinarum* by Long and Murry (1995, fig. 112A-D).

DISCUSSION

Because of their anatomical similarity to and co-occurrence with the holotype of *Typothorax coccinarum*, we consider the aetosaur specimens in the AMNH collection from Cerro Blanco (AMNH 2709-2713) to constitute topotypical specimens of *T. coccinarum* (Figs. 2-5). Comparison of these specimens to an essentially complete skeleton of *T. coccinarum* from east-central New Mexico (NMMNH P-12694) documents that they reflect well the diagnostic characteristics of *T. coccinarum*.

Typothorax long served as a wastebasket taxon to which much of the aetosaur material from the Chinle Group was referred. Thus, the aetosaur now recognized as *Longosuchus* was originally a species of *Typothorax* (Sawin, 1947), and specimens of *Paratypothorax* and *Redondasuchus* also have been assigned to the genus (e.g., Long and Murry, 1995; Martz, 2002).

There are two valid species of *Typothorax*: *T. coccinarum* and *T. antiquum* (Lucas et al., 2002). Parker (2007, p. 161) stated that "the holotype specimen of *Typothorax antiquum* Lucas et al. 2002 cannot be differentiated from material of *T. coccinarum*" but provided no justification for this claim. However, a substantial number of differences in the armor distinguish the two species, which are likely temporally successive representatives of an anagenetic evolutionary lineage (Lucas et al., 2002).

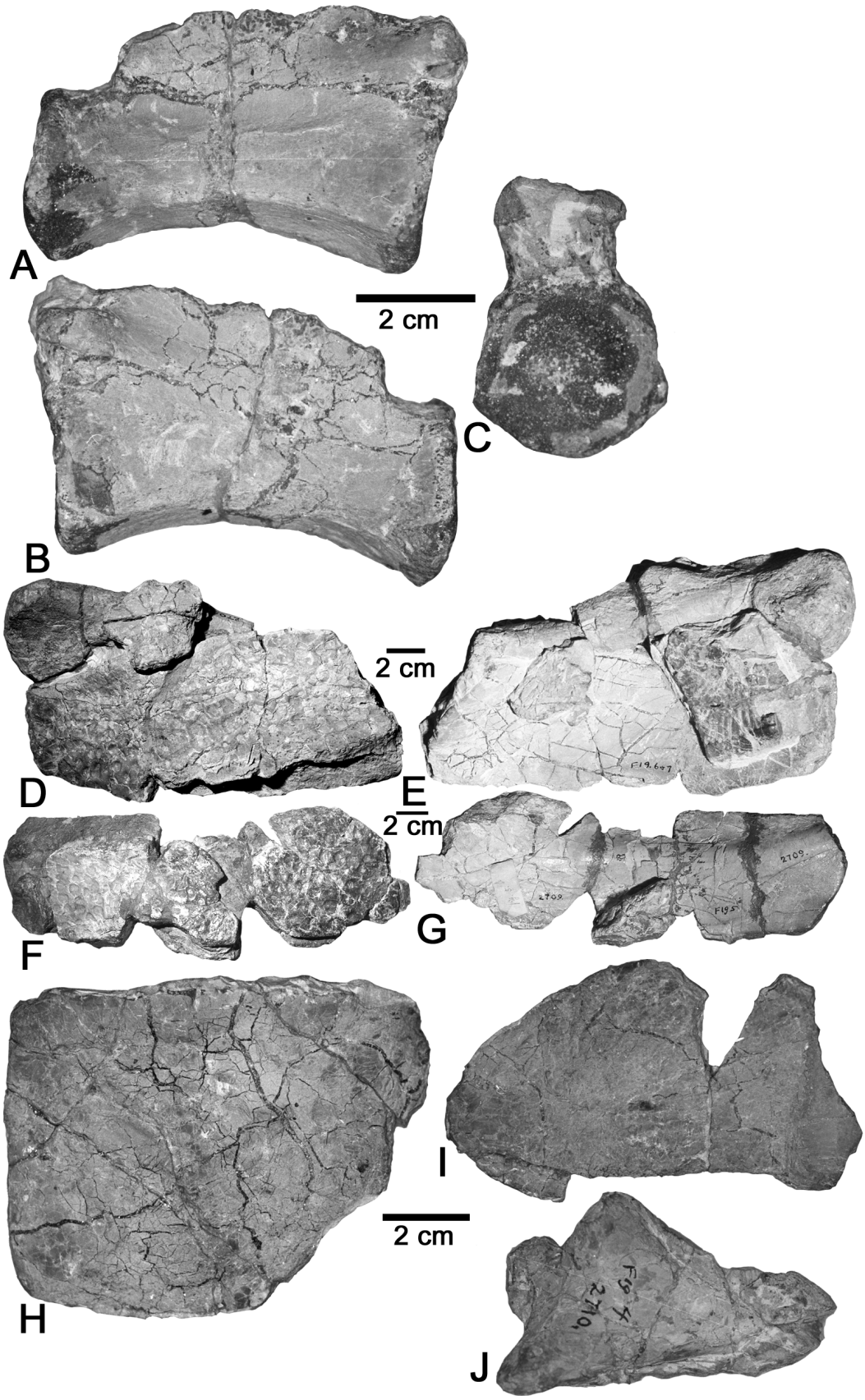

FIGURE 2. Topotypes of *Typothorax coccinarum*. **A-C**, **H-I**, AMNH 2713. **D-G**, AMNH 2709. **J**, AMNH 2710. **A-C**, complete caudal? centrum in **A**, right lateral, **B**, left lateral and **C**, anterior views. **D-E**, partial left? dorsal paramedian osteoderm in **D**, dorsal and **E**, ventral views. **F-G**, incomplete left? dorsal paramedian osteoderm in **F**, dorsal and **G**, ventral views. **H**, partial right? paramedian osteoderm in dorsal view. **I**, left lateral osteoderm in dorsal view. **J**, right? lateral osteoderm in posterior view.

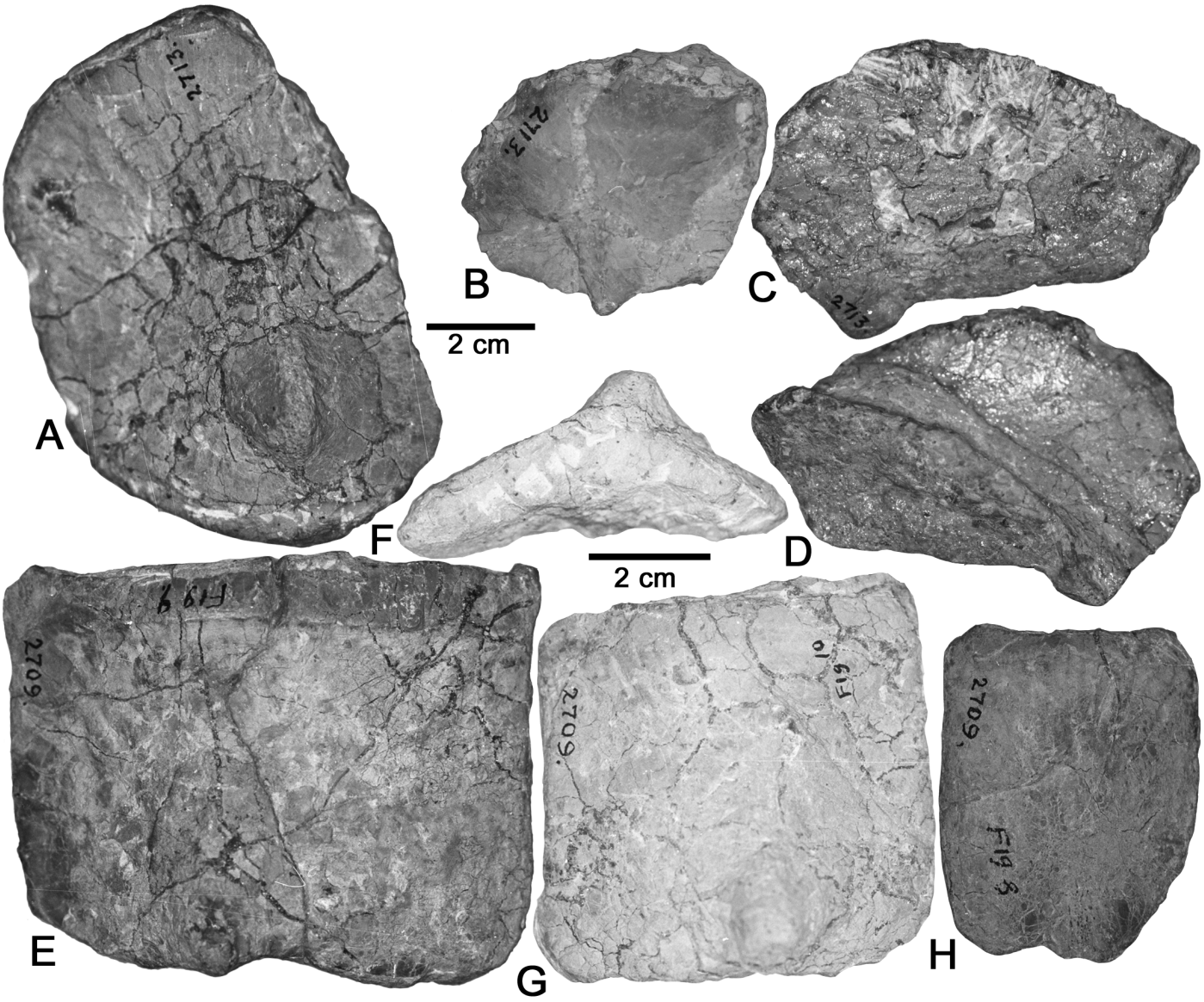

FIGURE 3. Topotypes of *Typothorax coccinarum*. **A-D**, AMNH 2713. **E-H**, AMNH 2709. **A**, complete left dorsal caudal paramedian osteoderm in dorsal view (lectotype of *Episcoposaurus horridus*). **B**, partial left dorsal caudal paramedian in dorsal view. **C-D**, incomplete right ?lateral osteoderm in **C**, dorsal and **D**, ventral views. **E**, partial left dorsal caudal paramedian osteoderm in dorsal view. **F-G**, complete left dorsal caudal paramedian osteoderm in **F**, posterior and **G**, dorsal views. **H**, partial ?right dorsal caudal paramedian osteoderm in dorsal view.

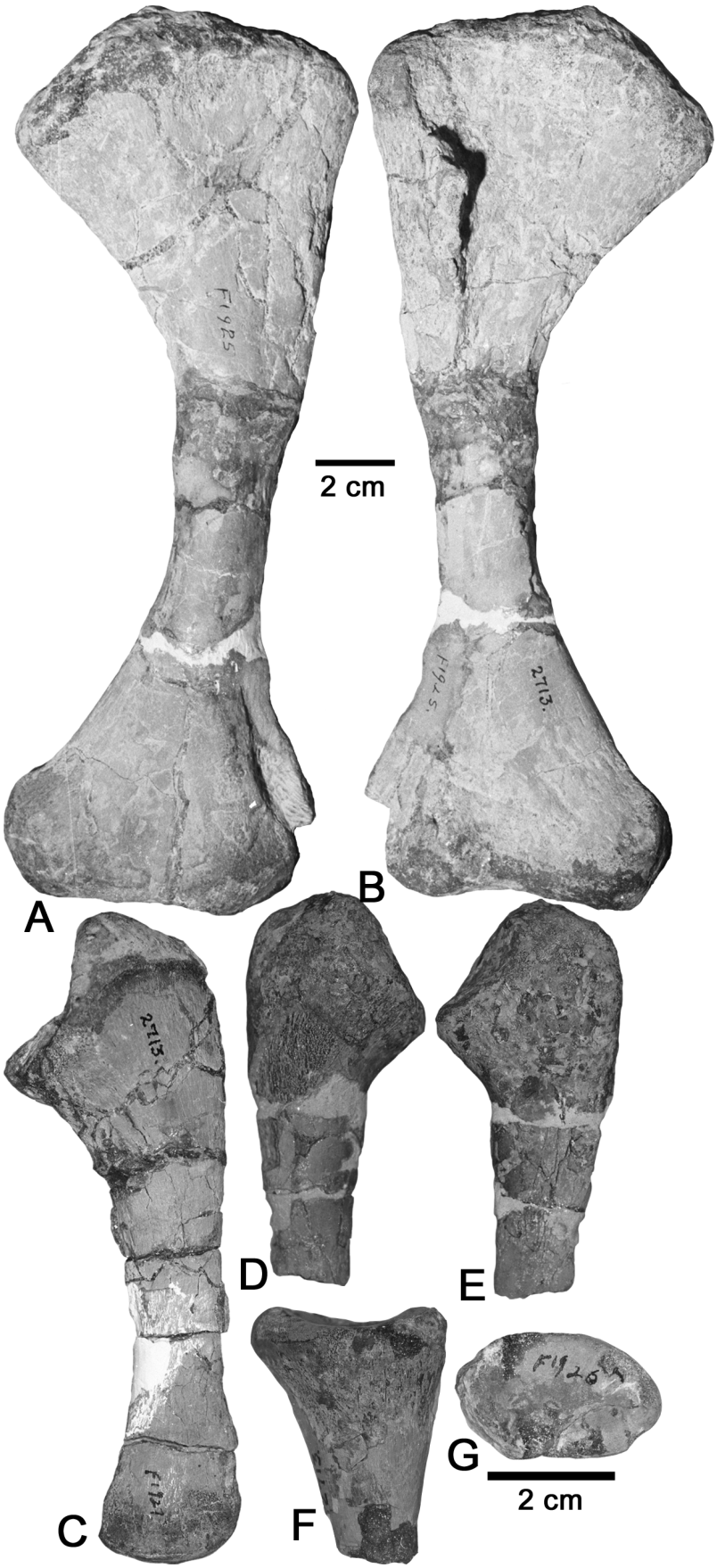

FIGURE 4. Topotypes of *Typothorax coccinarum*. **A-C**, **F-G**, AMNH 2713. **D-E**, AMNH 2711. **A-B**, right humerus in **A**, anterior and **B**, posterior views. **C**, left ulna in lateral view. **D-E**, proximal right ulna in **D**, lateral and **E**, medial views. **F-G**, proximal left? radius in **F**, lateral and **G**, proximal views.

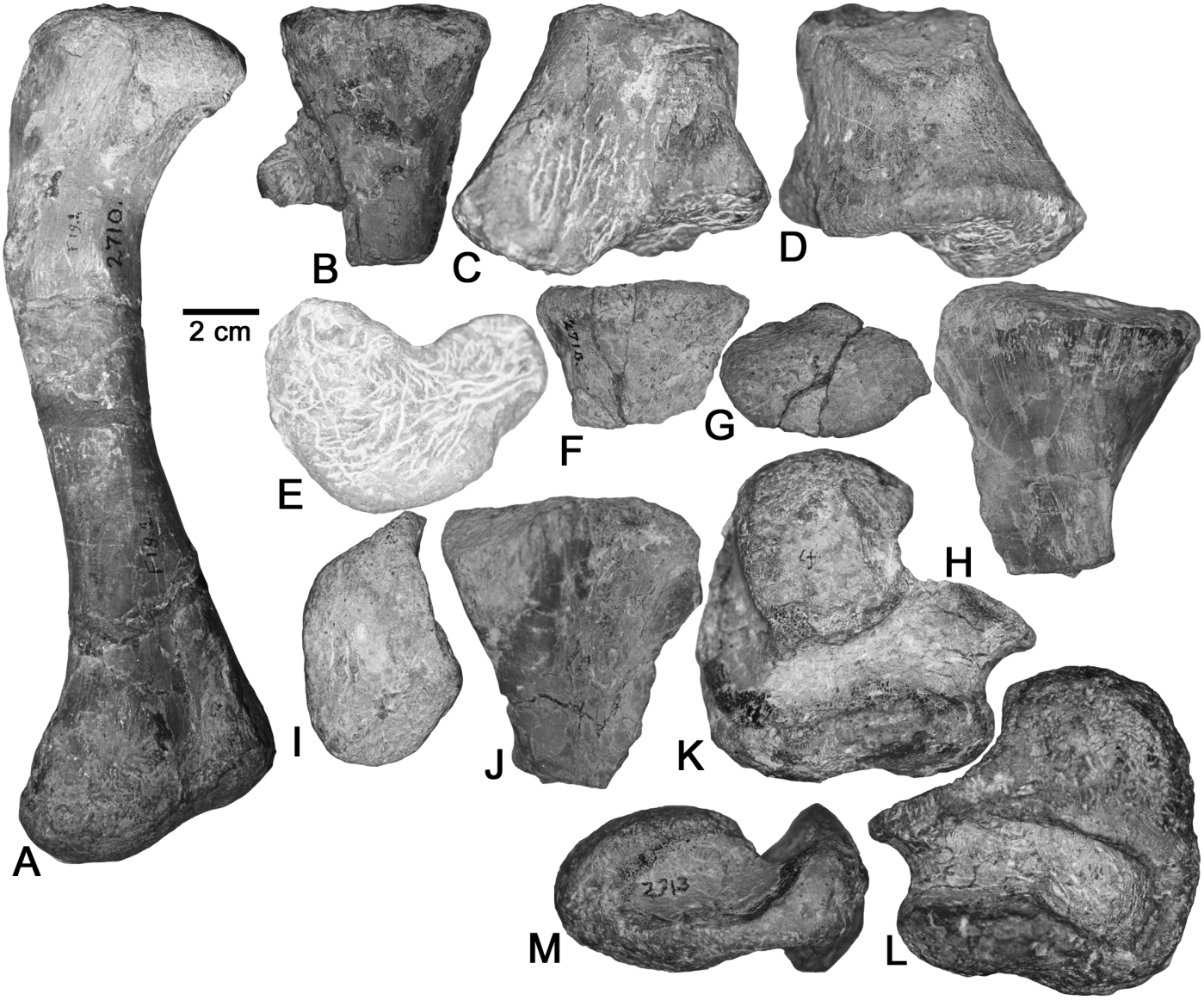

FIGURE 5. Topotypes of *Typothorax coccinarum*. **A-B**, AMNH 2710. **C-G**, **K-M**, AMNH 2713. **H-J**, AMNH 2711. **A**, right femur in posterior view. **B**, left? proximal tibia in ?lateral view. **C-E**, distal tibia in **C**, ?medial, **D**, ?lateral and **E**, distal views. **F-G**, right? proximal tibia in **F**, medial and **G**, proximal views. **H-J**, right? proximal tibia in **H**, medial, **I**, lateral and **J**, proximal views. **K-M**, left calcaneum in **K**, proximal, **L**, distal and **M**, dorsal views.

ACKNOWLEDGMENTS

E. Gaffney and C. Holton made it possible to study specimens in the AMNH collection. Jerry Harris and Larry Rinehart provided helpful reviews of the manuscript.

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